Permit Fact Sheet
Montana Ground Water Pollution Control System (MGWPCS)

Permittee:	Graham Development, LLC
Permit No.:	MTX000177
Facility Name:	Countryside Estates Subdivision
Facility Location:	Southwest corner of Royal Road and Amsterdam intersection. Northeast ¼ of Section 9 and NW/4 of Section 10, Township 1 South, Range 4 East, Gallatin County
Facility Contact:	David Graham/owner 257 Eze Street Belgrade, Montana 59714 Phone: (406)580-8312 Fax: (406)358-1566
Receiving Water:	Class I Ground Water
Number of Outfalls: Outfall(s)/Type:	1 001 – Subsurface Drainfield

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I. PERMIT STATUS

This statement of basis is for the issuance of a new wastewater discharge permit for Countryside Estates Subdivision (CES), which is owned by David Graham, pursuant to the Montana Ground Water Pollution Control System (MGWPCS). Graham Development, LLC, the permittee submitted a permit application (GW-1) that was received by the Department on March 28, 2006. The application was determined to be deficient on April 4, 2006, June 23, 2006, and July 19, 2006. This application was determined to be complete on August 8, 2006. This is a new source and is therefore subject to the Montana Nondegradation Policy (75-5-303, MCA) and administrative rules (ARM 17.30.701, et seq.).

This proposed subdivision is also subject to review and approval under the Montana Sanitation in Subdivision Act. The applicant submitted plans and specifications for review on March 20, 2006 to the Department's subdivision section. A Certificate of Subdivision Plat Approval is pending for EQ#06-2669.

II. FACILITY INFORMATION

A. General Description

CES will consist of 67 lots. There will be 62 lots for single-family residential homes, four (4) lots for commercial office buildings, and a 10-unit apartment building. There are also lots for twenty (20) three-

bedroom homes included in this development that will be built in the future (the "Bean" property), for a total of 87 lots. The proposed development will encompass approximately 76 total acres. CES will be located approximately two (2) miles west of the town of Belgrade.

B. Wastewater Collection, Treatment, and Disposal

Each lot will have an individual septic tank with a filter to remove floatable and setteable solids in the raw sewage. Residential lots will have at least a 1,000-gallon septic tank. Each of the four (4) commercial lots will have a 1,500-gallon septic tank, and the multi-family building will have a 7,000-gallon septic tank. The Bean lots will also have individual septic tanks with filters.

Wastewater collected from the septic tanks will gravity drain to a 10,000-gallon pump station via a sanitary sewer system. A force main will take the wastewater to a 30,000-gallon recirculation tank. The influent wastewater will leave the recirculation tank at a ratio no less than four (4) treated effluent parts, to one (1) part untreated wastewater. Level II wastewater treatment will occur in an Orenco AdvanTex AX100 9 POD recirculating trickling filter system, which will be followed by ultraviolet (UV) disinfection. The UV treatment will consist of one Megatron Model M250 unit capable of treating effluent flows at a maximum rate of 450 gallons per minute (gpm). The effluent will be discharged to a 10,000-gallon dose tank with four (4) 29 horsepower pumps. After exiting the dose tank, flow volumes will be metered on each effluent flow line, separately, through four (4) Badger 6-inch recordall turbo flow meters, prior to discharging to a subsurface drainfield. The drainfield will consist of four (4) zones (see Attachment 1).

The design capacity for the CES wastewater treatment system is 38,700 gallons per day (gpd). The four commercial office buildings are proposed to contribute a maximum of 2,000 gpd of wastewater to the system, for an average annual contribution of 5.2%.

III. DESCRIPTION OF THE DISCHARGE

A. Outfall Location

The proposed permit authorizes the permittee to discharge residential strength wastewater from an Advantex treatment system to a subsurface drainfield (Outfall 001).

- Outfall 001 is located in the southwest corner of the CES at 45 degrees 46 minutes 2 seconds North latitude and 111 degrees 13 minutes 38 seconds West longitude. The Bean property is located southwest of the proposed drainfield area (Outfall 001).

B. Past Monitoring Data/Effluent Characteristics

1. Past Monitoring Data

This is a proposed site and the permittee has collected no wastewater samples for analysis.

2. Effluent Characteristics

Based on average performance of reported AdvanTex-AX100 Treatment Systems, the effluent that is discharged from a typical Orenco Advantex Recirculating Trickling Filter System (Level II treatment) is expected to have the following average chemical characteristics (Orenco, 2004):

- Biological Oxygen Demand (BOD) = 7.8 mg/L
  BOD concentrations were reduced an average of 97.8%, where influent data was available.
- Total Suspended Solids (TSS) = 6.3 mg/L
  TSS were reduced an average of 84.4%, where influent data was available.
- Total Nitrogen (TN) = 21.1 mg/L
- Ammonia, as nitrogen (N) = 2.5 mg/L
- Nitrate, as N = 13.6 mg/L

In addition, a USEPA Fact Sheet, TFS-9 (2002), entitled "Fixed-Film Processes (particularly trickling filters)" states that effluent that is discharged from a typical tricking filter to a drainfield is expected to have the following average chemical characteristics:

- Fecal coliform reductions are 1 to 2 logs
- Nitrogen removal varies from 65 to 75% according to TSF-51, Table 1,USEPA (2002)
- Phosphorous removal ranges from 10 to 15 percent

The wastes discharged to the wastewater treatment system must be domestic in nature and conform to residential strength, or are otherwise pre-treated or separated and an alternative means of disposal is established. However, if the wastewater that is collected, treated or discharged by this system contains any industrial waste or process wastewater, the permit will be reclassified from a domestic wastewater discharge to an industrial and other waste discharge. The permittee will be required to submit an application (Department GW-2) for an industrial and other waste discharge permit within 90 days of the inclusion of industrial waste or process wastewater to the facility's system. *Industrial waste* is defined in 75-5-103(12), MCA. *Process wastewater* is defined in ARM 17.30.1304(46).

IV. SITE CHARACTERISTICS

A. Soils

Soils of the Beaverell-Beavwan complex are found over 88.3% (67.6 acres) of CES, which includes the proposed wastewater treatment area. The easternmost 8.7 acres (11.3%) of the subdivision will be located in the Beaverell.

The Beaverell-Beavwan complex occurs on 0 to 2% slopes. At the surface to approximately 15 inches in depth, the Beavwan portion of the Beaverell-Beavwan complex consists of loam and clay loam. However, with depth the Beavwan becomes a gravelly to cobbly, sandy clay loam. From 22 to 28 inches below ground surface (bgs) these soils are composed of cobbly to gravelly sandy loam with increasing cobbles and gravels from 26 to 60 inches deep.

The Beaverell soils identified in the eastern portion of the site have a higher percentage of cobbles at the surface than the Beavewan and are described as a cobbly loam. The cobble content increases with depth. At 24 to 60 inches bgs the Beaverell becomes a cobbly to gravelly, coarse sand.

The highest percentage of clay (20 to 30%) in both the Beavwan and the Beaverell is from 5 to 20 inches deep. The clay content decreases rapidly with depth and is minimal to non-existent from 24 to 60 inches (2 to 5 feet) bgs.

Seven (7) individual percolation tests (PTs) were conducted in and around the proposed drainfield and drainfield replacement areas to depths ranging from 24 to 30 inches (2 to 2.5 feet) bgs (see Attachment 2). PTs conducted in the center and east of the center of the proposed drainfield area are significantly slower (PT 1 = 10.98 minutes/inch, PT 2 = 17.25 min/in, and PT 3 = 20.31 min/inch), than those (PT 6 and PT 7) located in the southwest portion of the replacement area. PT 6 & 7 were much faster at 2.16 min/in and 1.46 min/in, respectively. Therefore, the sandy coarse gravel described in PT 1, 2, and 3 is less permeable than the extremely gravelly coarse sand encountered in PT-6 and PT- 7.

A total of seven (7) test holes (TH) were dug with a backhoe in and around the proposed drainfield and drainfield replacement areas (see Attachment 2). These THs ranged in depth from 8 to 10 feet bgs. The locations of the THs are in the immediate area of the similarly numbered PTs. In general, from the ground surface to approximately 2 feet deep, organic clay with some sand and some gravel was encountered in the THs. From 2 to 5 feet bgs sandy coarse gravel to gravelly sands were described.

With increasing depth (6 to 10 feet), the subsoils demonstrate north-south depositional environment trends paralleling the present-day Gallatin River channel. Coarser sediments are found on the west and southwest sides of the CSE development (closer to the Gallatin River) and grade to finer materials east of the proposed drainfield areas. Subsoils in THs #1005, #1006, and #1007 located in the west half of the proposed drainfield areas bottomed in gravelly sand. THs #1001 and #1003 located in the center and east half, respectively of the proposed drainfield areas were stopped in sandy coarse gravel. While THs #1002 and #1004 along the east side of the drainfield areas were dug into sand lenses and fine sandy medium gravel, respectively.

B. Geology

The variable stratigraphy and natural sorting of the sediments in this area suggests a Quaternary alluvial depositional environment associated with braided river floodplains. Rapid to abrupt transitions from fine-grained clayey (with cobbles) materials to coarse sands and gravels are common in the subsurface in these areas due to the variable stream velocities encountered throughout the ever changing meandering river system over time.

Today, this area is classified by the Federal Emergency Management Agency (FEMA) on the Flood Insurance Rate Map (FIRM, 1984) as “Zone C”. Zone classifications are defined according to varying levels of flood risks, including the severity or type of flooding in the area. Zone C represents areas of moderate to low risk. These areas have less than a 1% chance of flooding each year, less than a 1% chance of sheet flow flooding with an average depth of less than 1 foot, less than a 1% chance of stream flooding where the contributing drainage area is less than 1 square mile, or are areas protected from floods by levees. No base flood elevations or depths are shown within the “C” zone map area.

C. Hydrogeology

No ground water was encounter in the THs which were dug to a maximum total depth of 10 feet bgs. Boring logs from five (5) wells in or immediately adjacent to the CES property are completed in the shallow Quaternary gravels and are identified in the table below.

Table 1 Local Shallow Ground Water Wells

Well Name	GWIC Number/Attachment 2 Map Well Number	Completion Date	Total Depth (feet)
Brad Bean	90979/#5	12/29/89	58.50
South Well (Irrigation)	222316/#4	11/10/05	80
North Well (Irrigation)	222317/#3	11/10/05	80
Mazza Residence	86292/#2	5/31/90	63
Leibrand Residence	91017/#1	11/1/79	68

These wells are all open bottom completions ranging from 58.5 to 80 feet deep (average depth of 71.2 feet). SWLs range from 18 feet to 35 feet below the top of the well casing (average SWL is 27.2 feet).

D. Hydrology

By contouring the ground water elevations (measured on 6/15/06) from the five local wells tabulated above (see Table 1 and Attachment 2), the direction of ground water flow was determined to be approximately N30°E at a hydraulic gradient of 0.0089 ft/ft. A ground water elevation measured on July 18, 2006, in the Kerin and Associates Well#1 (GWIC #1911724), which is located in the easterly subdivision street (Countryside Lane) confirmed the above interpretation.

A 4-hour aquifer pump test was conducted at the South Irrigation Well (GWIC #22316). From this pump test data, the Department calculated a transmissivity of 7,302.23 ft^2/day based on the pumping rate of 120 gallons per minute (gpm) and a time-drawdown of 0.58 feet. Using a 47-foot water column in the well, the hydraulic conductivity is 155.37 ft/day. A similar hydraulic conductivity of 141 ft/day was calculated from an aquifer pump test conducted in Section 4, to the north of the proposed CES at the High K Subdivision.

The nearest hydraulically downgradient surface water from Outfall 001 is the Durham Ditch. This ditch is located approximately 0.75 miles in a N30°E direction from the proposed drainfield area. The Gallatin River is 0.4 miles west of the site. Hoffman Ditch is 150 feet west of the drainfield replacement area. An unnamed tributary of the Gallatin River comes within 200 feet of the replacement area.

V. RECEIVING WATER

A. Water-Use Classification and Applicable Water Quality Standards

A ground water sample was collected from the South Irrigation Well (GWIC #222316) on December 1, 2005. This well is located approximately 300 feet northeast of the northeast corner of the proposed drainfield and cross-gradient to the east of the standard 500-foot mixing zone. The laboratory analysis measured a concentration of 0.4 mg/L nitrate + nitrite (as N) and a specific conductivity of 320

μmhos/cm.

Ground water analytical data from a sample collected on July 24, 2006, from the Brad Bean Well (GWIC # 90979) located approximately 360 feet southwest of the southwest corner of the proposed drainfield and hydraulically upgradient from the site, reported a nitrate + nitrite (as N) concentration of <0.1 mg/L. The specific conductivity was measured at 285 μmhos/cm. The Bean Well is completed in the shallow alluvial gravel aquifer as an open bottom completion at a total depth of 58.5 feet bgs. The original static water level was reported at 18 feet deep. More current measurements show the SWL on June 15, 2006 at 14.09 feet from the top of casing (TOC), and on July 18, 2006 at 17.85 feet from the TOC. The ground water quality from the Brad Bean Well is representative of hydraulically upgradient conditions in the shallow gravel aquifer in this area.

The nitrate (as N) concentration in the ground water across this site ranges from a low of <0.1 mg/L in the hydraulically upgradient Bean Well (GWIC#90979), to 0.4 mg/L downgradient from the proposed subsurface drainfield area in the South Irrigation Well (GWIC#222317). The average nitrate (as N) concentration is 0.25 mg/L. Temporal, spacial, and seasonal variations in nitrate (as N) concentrations in the ground water are minimal in this area. SWL elevations do vary seasonally.

Based on the above specific conductivity values (285 and 320 μmhos/cm), the receiving water for Outfall 001 is Class I ground water. Class I ground water has a specific conductivity of less than or equal to 1,000 μmhos/cm at 25 degrees Centigrade, as defined by ARM 17.30.1006(1). According to ARM 17.30.1006(1)(a), the quality of Class I ground water must be maintained so that these waters are suitable for public and private water supplies, culinary and food processing, irrigation, commercial and industrial purposes, drinking water for livestock and wildlife, with little or no treatment. Human health standards listed in DEQ Circular 7 (February 2006) apply to concentrations of dissolved substances in Class I ground water.

The applicable ground water quality standards and nondegradation significance criteria are included in Table 2.

Table 2. Applicable Water Quality Standards and Nondegradation Significance Criteria

Parameter	DEQ Circular 7 Human Health Ground Water Standards	Nondegradation Significance Criteria in Ground Water for Level II Treatment
Nitrate (as N)	10 mg/L	7.5 mg/L
Total Phosphorus (TP)	no standard	50 year breakthrough [(1)]
E-Coli Bacteria	<1 organism per 100 ml	<1 organism per 100 ml

[1] The phosphorus significance criteria is listed in ARM 17.30.715(1)(e): "changes in concentration of total inorganic phosphorus in ground water if water quality protection practices approved by the department have been fully implemented and if an evaluation of the phosphorus adsorptive capacity of the soils in the area of the activity indicates that phosphorus will be removed for a period of 50 years prior to a discharge to any surface waters."

VI. MIXING ZONE

The permittee has proposed to discharge all wastewater from Outfall 001 and has requested a standard ground water mixing zone of 500 feet (ARM 17.30.517) for Outfall 001 (see Attachment 2). The

permittee must comply with the ground water mixing zone rules pursuant to ARM Title 17, Chapter 30, Subchapter 5. Ground water standards may be exceeded within the mixing zone, provided all existing and future beneficial uses of the state waters are protected [ARM 17.30.1005]. The shape of the mixing zone is determined using the drainfield dimensions and information on water table elevations.

The shallow ground water flow direction is approximately N30°E. This determination was made based on a ground water flow map contoured on current (6/15/06) SWL elevations in five (5) local shallow wells and one additional well that was measured on 7/18/06. These are the same 6 wells mentioned above, which are located on or immediately adjacent to CES property. The hydraulic gradient of 0.01 ft/ft was calculated using this ground water elevation data and the contoured ground water flow map (Attachment 2).

Ground water sample analysis from a sample collected (7/24/06) and analyzed from the Brad Bean Well indicates less than 0.1 mg/L as the background nitrate + nitrite (as N) concentration in the shallow alluvial gravel aquifer. This well is located hydraulically upgradient to the proposed drainfield area and to the proposed standard 500-foot mixing zone. The width of the drainfield perpendicular to the direction of ground water flow is 330 feet.

The permittee will be required to comply with the applicable ground water quality standards at the boundaries of the mixing zone [ARM 17.30.508(1)(a), ARM 17.30.1006(1)(b), DEQ Circular 7]. A standard 500-foot ground water mixing zone will be granted for an individual parameter of nitrate (as N) [ARM 17.30.505(1)(a)]. The concentration of pollutants has been estimated based on a mass balance calculation at the downgradient boundary of the proposed standard 500-foot mixing zone.

VII. PROPOSED EFFLUENT LIMITS

Data show Orenco AdvanTex AX100 9 POD wastewater treatment systems produce a high quality effluent, and are considered to be a Level II treatment according to ARM 17.30.702(11). Level II wastewater treatment systems must provide a higher degree of treatment than a conventional wastewater treatment system. A Level II system must provide at least a 60 percent removal of total nitrogen (TN) in the raw wastewater or an effluent TN concentration of 24 mg/L or less beneath the drainfield [ARM 17.30.702(11)]. The Department has established that a properly installed, operated and maintained AdvanTex wastewater treatment system meets the definition of a Level II system.

The permit limit for TN will be set at 26 mg/L in the effluent, prior to discharge to the drainfield because an additional 7% of nitrogen removal is assumed to occur within the drainfield providing a final TN concentration discharged to ground water of 24 mg/L. Based on the performance of the system, the technology-based effluent limits (TBELs) for TN and total phosphorous (TP) are set forth in Table 3.

Table 3. Technology-Based Effluent Limits for Outfall 001 (at the dose tank prior to discharge to the subsurface drainfields)

Parameter	Daily Maximum[(1)] Concentration (mg/L)
Total Nitrogen, as N (TN)	26
Total Phosphorous, as P (TP)	NA

(1) See definitions, Part V. of the permit.
NA = Not Applicable

VIII. PROPOSED WATER QUALITY-BASED EFFLUENT LIMITS

The Montana Water Quality Act requires that a discharge to state waters shall not cause a violation of a water quality standard outside a Department authorized mixing zone. Ground water quality standards apply at the hydraulically downgradient mixing zone boundary in the unconfined aquifer. Water quality limitations must be established in permits to control all pollutants or pollutant parameters that are or may be discharged at a level which will cause, have reasonable potential to cause or contribute to an excursion above any state water quality standard. The permittee must comply with Montana Numeric Water Quality Standards included in DEQ Circular 7 (February 2006) and the protection of beneficial uses (ARM 17.30.1006). Ground water quality standards may be exceeded within a Department authorized mixing zone, provided that all existing and future beneficial uses of the state waters are protected (ARM 17.30.1005).

A. Nitrate

The proposed wastewater system constitutes a new source [ARM 17.30.702 (18)(a)]. The Class I ground water is considered high quality water and is subject to Montana's Nondegradation Policy (75-5-303, MCA). The applicable ground water standard is based on nondegradation, with a nitrate concentration limit of 7.5 mg/L [ARM 17.30.715 (1)(d)(iii)] at the end of the proposed standard, 500-foot mixing zone.

The total nitrogen (TN) concentration is the sum of nitrate plus nitrite, as nitrogen (N) plus total Kjeldahl Nitrogen (as N). The Department assumes all the nitrogen discharged to the drainfield in the effluent is converted to nitrate, as (N).

The allowable discharge concentration is derived from the mass balance water quality equation which considers dilution and background concentration of the receiving water (EPA, 2000).

$$C_2 = \frac{C_3(Q_1 + Q_2) - C_1 Q_1}{Q_2}$$

$$C_2 = 20 \text{ mg/L}$$

C_1 = average ambient ground water concentration is 0.25 mg/L
C_2 = allowable discharge concentration (TN) beneath the drainfield
C_3 = ground water concentration limit for pollutant (from DEQ Circular 7 or other appropriate water quality standard) at the end of the mixing zone is 7.5 mg/L, instantaneous (no single sample shall exceed)
Q_1 = ground water volume is 8,846.42 ft^3 / day
Q_2 = maximum flow of discharge (design capacity of system is 5,173.80 ft^3 / day)

The volume of ground water that will mix with the discharge (Q_1) is estimated using Darcy's equation: $Q_1 = K\ I\ A$. The calculated value of Q_1 is 8,846.42 ft^3/day for the mixing zone; assuming an aquifer K value of 155.37 ft/day (4-hour pump test), a measured hydraulic gradient of 0.0089 ft/ft (ground water flow/site map – Attachment 2), and a cross sectional area of flow at the downgradient boundary of the standard 500-foot mixing zone of 6,397.50 ft^2.

The design capacity of the wastewater disposal system is 38,700 gpd, or 5,173.80 ft^3/day. The nitrate (as N) concentration must not exceed 7.5 mg/L at the end of the mixing zone. The average ambient

concentration of nitrate-nitrogen in the alluvial ground water is 0.25 mg/l (C_1) [Bean well, 7/24/06 and South Irrigation Well 12/1/05]. It is assumed that the entire TN load in the effluent converts to nitrate (as N) and enters the ground water.

The projected maximum concentration of the TN in the effluent discharged to ground water must not exceed 21.4 mg/L at Outfall 001. This effluent limit ensures the nitrate (as N) concentration at the end of the ground water mixing zone is at or below the nondegradation significance criterion of 7.5 mg/L. As discussed in Part VII, nitrate reduction of approximately 7 percent is assumed to occur beneath the drainfield. Therefore, to discharge a TN concentration of 20 mg/L below the drainfield, the effluent limit from the AdvanTex system at the dose tank prior to discharge to the subsurface drainfields is calculated at 21.4 mg/L of TN.

20 mg/L (.07) = 1.4 mg/L	Assumed nitrate reduction beneath the drainfield.
20 mg/L + 1.4 mg/L = 21.4 mg/L	Maximum concentration of TN at the dose tank, prior to discharge to the subsurface drainfield (Outfall 001).

The calculated effluent concentration of TN must not exceed 20 mg/L in order to maintain a concentration that is less than the state water quality standard of 7.5 mg/L for nitrate (as N) in the ground water at the mixing zone (Part VI) boundary. Since the TBEL for the TN concentration in the effluent from a Level II AdvanTex treatment system is typically 26 mg/L (Part VII), the WQBEL will be based on the continuous (90-day average) flow rate for the system (38,700 gpd maximum) and the daily maximum concentration (mg/L) as the TN load in pounds per day. These limits do not take into account other factors involved in predicting pollutant transport, such as biological denitrification below the drainfields. The WQBEL effluent limit will be expressed as a load limit using the following equation:

Load limit (lbs/day) per outfall = 90-day average effluent flow rate (gpd) ***x*** *daily maximum effluent concentration (mg/L)* ***x*** *8.34 x* 10^{-6}

Load limit (lbs/day) per outfall = (38,700 gpd) **x** (20 mg/L) **x** (8.34 x 10^{-6})

Load limit (lbs/day) per outfall = 6.46 lbs/day

B. Phosphorus

Phosphorus is removed mainly through soil sorption processes, which are slow and vary based on soil composition. The total phosphorus (TP) limitations are imposed to ensure that the quality of the effluent meets the nondegradation limit prior to discharge into any surface water [ARM 17.30.715(1)(e)]. The effluent limits do not include a concentration limit for phosphorus because of the method used to determine compliance with the 50-year breakthrough criteria. The 50-year breakthrough nondegradation criterion is based on the amount of soil available to adsorb the phosphorus between the discharge point and the surface water and the average load of phosphorus from the wastewater source. Total phosphorus of 10.6 mg/L is consistent with the concentration found in residential wastewater. The estimated load from this facility is approximately 3.42 pounds per day (lbs/day). The adsorption capacity of the soil is based on the total load of phosphorus, it is not concentration dependent.

The nearest downgradient receiving surface water is Durham Ditch. It is located approximately 0.75 miles N30°E (hydraulically downgradient direction) from the proposed drainfield area. A phosphorous breakthrough analysis shows the breakthrough time to the surface water is 184.9 years (using 6.81

lbs/yr/lot) and the discharge is considered nonsignificant degradation pursuant to the criteria of ARM 17.30.715(1)(e).

C. E-Coli Bacteria

A wastewater treatment system that is sited and operated properly should remove most, if not all, of the pathogenic bacterial indicators within 2 to 3 feet of the drainfield's infiltrative surface (USEPA, 2002). There is no mixing zone for e-coli bacteria. The point of compliance is at the edge of the drainfield/outfall. The e-coli water quality standard is <1 organism per 100 ml in the ground water (DEQ Circular 7, 2/06). Based on the following site-specific criteria, ground water monitoring for e-coli bacteria at the edge of the drainfield will not be required at this time.

- The effluent will undergo ultraviolet (UV) disinfection treatment prior to being discharged to the ground water.

In addition, the systematic pressure-dosing of the drainfields will minimize saturated conditions and maximize the die-off rate in the natural sediments. The proposed subsurface drainfields will discharge effluent approximately 2 feet below the ground surface. The depth to ground water at this site ranges from 18 to 25 feet below TOC. This may provide an adequate soil-subsoil column where treatment may occur naturally in the unsaturated zone.

Ground water monitoring for e-coli bacteria will be required at the boundary of the standard 500-foot mixing zone to ensure disinfection is occurring.

D. BOD5 and TSS

BOD_5 and TSS are monitored for wastewater treatment system efficiency to ensure the effective removal of biological material and that the proper aerobic biological processes are being maintained. There are no numeric ground water quality standards for BOD and TSS, however according to ARM 17.30.1006(1)(b)(ii) the beneficial uses for a Class I ground water must be maintained. BOD and TSS are not subject to nondegradation unless they have a reasonable potential to affect a beneficial use based on the significance criteria for BOD and TSS, which are narrative [ARM 17.30.715 (1)(g) and DEQ Circular 7].

The WQBELs are listed in Table 4.

Table 4. Water Quality-Based Effluent Limits for Outfall 001 (at the dose tank prior to discharge to the subsurface drainfields)

Parameter	Daily Maximum[(1)] Concentration (mg/L)	90-Day Average Load[(1)] (pounds per day)
Total Nitrogen, as N [TN]	26	6.46
Total Phosphorus, as P [TP]	NA	3.42

(1) See definitions, Part V of the permit
NA Not Applicable

IX. PROPOSED FINAL EFFLUENT LIMITS

The proposed effluent limitations for Outfall 001 are summarized in Table 5 and are based on the more restrictive of the technology, water quality and nondegradation significance water quality criteria discussed in previous sections. The final proposed effluent limit for TN is water quality-based, relating to the expected performance of the AdvanTex system and the subsurface drainfields with proper operation and maintenance. The load limit is proposed based on the design capacity and the WQBEL concentration. The concentration limit is proposed to ensure the system operates at the Level II requirement with an effluent concentration of TN at Outfall 001, not to exceed 24 mg/L, as specified in ARM 17.30.702(11).

The load limit for TN is based on the nondegradation criteria of 7.5 mg/L for nitrate (as N) in ground water. The concentration limit is based on ARM 17.30.715(1)(d)(iii) for level II treatment.

The effluent limit for TP is water quality-based as determined according to nondegradation significance criteria. The water quality-based effluent load limit considers the assimilative capacity of the soil system to estimate the maximum load of phosphorus discharged to the ground water without exceeding the 50-year breakthrough. The 90-day average load limit will provide protection for the surface and ground water.

Table 5. Numeric Effluent Limits for Outfall 001 (at the dose tank)

Parameter	Daily Maximum Concentration [(1)] (mg/L) per Outfall	90-Day Average Load[(1)] (pounds per day) per Outfall
Total Nitrogen, as N (TN)[(2)]	26	6.46
Total Phosphorus, as P (TP)	NA	3.42

(1) See definitions, Part V of the permit.
(2) Total Nitrogen (TN) is the sum of nitrate, nitrite and total kjeldahl nitrogen (as N).
NA Not Applicable

Other Discharge Limitations:

The average daily flow of effluent discharged to Outfall 001 shall not exceed 38,700 gpd.

A. Other Conditions

1. Operation and Maintenance

According to DEQ Circular 4 - Chapter 7 and Appendix D, individual treatment systems are the responsibility of the owner of the residence to provide proper operation and timely maintenance of the unit.

Community wastewater treatment and disposal systems are to be operated and maintained according to the manufacturer's instructions as provided in an owner's manual (DEQ Circular 4, Appendix D). Proper operation and maintenance (O&M) must be assured through an initial and a renewed service contract for the life of the system. A two-year initial service policy must be provided to the owner by the designer, manufacturer or authorized representative that will include the following conditions:

- An initial service policy containing provisions for four inspections (scheduled once every six months over the two-year period) and
- Written notification to the owner regarding a system malfunction, with proposed date for correction.

X. MONITORING REQUIREMENTS

A. Influent Monitoring

No influent monitoring will be required.

B. Effluent Monitoring

Effluent monitoring is essential to ensure the effective treatment and consistency of the wastewater discharged from the facility. The effluent limits are established to protect the ground water from a change in water quality that would cause degradation [ARM 17.30.715] or cause a change in beneficial use [ARM 17.30.1006(1)(a)]. Samples or measurements shall be representative of the volume and nature of the monitored discharge at the outfall.

Effluent monitoring/sampling shall be conducted by collecting a composite sample from the wastewater treatment system dose tank that is most representative of the discharge prior to discharging to the subsurface drainfield area (Outfall 001). Dose tank samples shall be submitted to the laboratory for analysis of all of the parameters in Table 5.

The permittee shall monitor the effluent at Outfall 001 for the parameters in Table 6 and at the frequency and with the type of measurement and sampling as indicated. If no discharge occurs during the entire monitoring period, it shall be stated in a Discharge Monitoring Report (DMR) that "no discharge" occurred.

Table 6. Outfall 001 Effluent Parameters Monitored/Sampled at the Dose Tank

Parameter, units	**Frequency**	**Sample Type[(1)]**
Effluent Flow Rate, gpd[(2)]	Continuous	Continuous
Total Suspended Solids (TSS), mg/L	Quarterly	Composite
Biological Oxygen Demand (BOD_5), mg/L	Quarterly	Composite
pH, s.u.	Quarterly	Composite
Total Phosphorus,as P (TP)[(3)], mg/L	Quarterly	Composite
Nitrate (as N), mg/L	Quarterly	Composite
Nitrate + Nitrite (as N), mg/L	Quarterly	Composite
Ammonia, (as N), mg/L	Quarterly	Composite
Oil and Grease, mg/L	Quarterly	Composite
Total Kjeldahl Nitrogen (TKN) (as N), mg/L	Quarterly	Composite
Total Nitrogen, as N (TN), mg/L	Quarterly	Calculated[(4)]
Total Nitrogen, as N (TN), lb/da[(5)]	Quarterly	Calculated[(6)]

Total Phosphorus, as P (TP), lb/da[5]	Quarterly	Calculated[6]

(1) See definitions in Part V of this permit.
(2) To be measured by a recorder or totalizing flow meter.
(3) EPA Method 365.1 or equivalent
(4) Total Nitrogen (as N) TN = (nitrate + nitrite, as N) + total Kjeldahl (TKN)
(5) Average daily load calculations: lb/da = concentration (mg/L) x flow (gpd) x 8.34 x 10^{-6}
(6) See definition of "quarterly average" in Part V of this permit..

The 90-day average load for TN and TP are the sum of the calculated loads for each TN and TP sample collected within the 90-day period, divided by the number of samples collected and analyzed for TN and TP.

The effluent flow measurement method shall be either by recorder or totalizing flow meters; dose counts or pump run-times will not be accepted for new wastewater systems. The permittee shall monitor the flow of the effluent for Outfall 001 prior to entering the subsurface drainfield. The permittee shall report the flows for Outfall 001 based on the average for each quarter. The permittee has stated the method of flow monitoring will be four (4) Badger 6-inch recordall turbo flow meters. The Badger flow meters will be located on each of the four effluent lines exiting the dose tank prior to discharging to the respective zones (4) in the subsurface drainfield.

C. Ground Water Monitoring

Ground water monitoring will be required in this permit due to the following site-specific criteria:

- The depth to shallow ground water ranges from 18 to 25 feet from the TOC, with ground water being the shallowest in the area of the proposed drainfield, increasing in depth to the east and northeast across the site.
- In this area, shallow soils and subsoils (to 10 feet bgs) demonstrate north-south trends with the coarser materials (sandy coarse gravel) identified to the west grading across the site, to fine sandy medium gravel on the east.
- The four (4) or more domestic supply wells located approximately 100 feet hydraulically downgradient ($N30^0E$) from the downgradient boundary of the standard 500-foot ground water mixing zone.

The permittee is required to monitor the ground water quality at the hydraulically downgradient boundary of the proposed standard 500-foot ground water mixing zone. The location of the monitoring well (MW1A) shall be 500 feet from the subsurface drainfield in a $N30^0E$ direction (see Attachment 2). MW1A shall be located along the south side of the south boundary of Block 5 in the "Park 2" area, opposite the mid point of Lot 5 (see Attachment 2). Any deviation from this required monitoring well location must be approved by the Department prior to well installation.

The ground water monitoring well (MW1A) will serve as a compliance point for the standard 500-foot ground water mixing zone. MW1A will also serve as a detection monitoring well for e-coli bacteria, to ensure the UV disinfection treatment system is operating effectively. If UV treatment is not installed as designed (see Attachment 1), an additional shallow ground water monitoring well will be required to be constructed at the hydraulically downgradient (northeast) edge of the subsurface drainfield.

MW1A shall be screened in the first shallow aquifer approximately from the top of the high ground water table to15 feet below the low water table.

The ground water monitoring well must be installed by a licensed monitoring well driller, according to monitoring well construction standards in ARM Title 30, Chapter 21, Subchapter 8. MW1A must be constructed and secured according to ARM 17.50.707. A copy of the completed driller's log must be submitted to the Department no later than 60 days from the date of permit issuance. The parameters to be monitored and the sampling frequency for the monitoring well are given in Table 7.

Table 7. Ground Water Monitoring Parameters for Monitoring Wells MW1A

Parameter, units	Frequency	Sample Type(1)
Static Water Level (SWL) (feet below top of casing)	Quarterly	Instantaneous
E-Coli Bacteria, organisms/100 ml	Quarterly	Grab
Nitrate + Nitrite (as N), mg/L	Quarterly	Grab
Nitrate (as N), mg/L	Quarterly	Grab
Total Kjeldahl Nitrogen (TKN), mg/L	Quarterly	Grab
Total Nitrogen (TN), mg/L	Quarterly	Grab
Specific Conductivity, µmhos/cm	Quarterly	Grab
Chloride, mg/L	Quarterly	Grab

(1) See definitions in Part V of this permit.

The monitoring of chloride and specific conductance is used as indicators of potential impacts from the wastewater to the ground water.

Ground water sample collection, preservation and analysis shall be conducted according to ARM 17.30.1007 and "Non-Point Source Water Quality Standard Operating Procedures" (4/1/95) at www.deq.state.mt.us/wqinfo/monitoring/SOP/Sap.asp, until the permit is issued.

No later than 60 days from the date of permit issuance, site specific ground water monitoring well sampling procedures and protocols [Standard Operating Procedures(SOP)/Sampling and Analysis Plan (SAP)] will be required to be submitted by the permittee and approved by the Department. A general ground water monitoring well operation and maintenance (O & M) plan will also be required to be submitted at that time. The initial ground water monitoring well sample must be collected prior to start-up of the wastewater treatment system and quarterly thereafter.

D. Corrective Action – Ground Water Compliance Limits

The ground water compliance limits and water quality standards for monitoring well MW1A are listed in Table 8. An exceedance of a ground water compliance limit(s) for nitrate (as N) in MW1A demonstrates that the compliance limit has been exceeded at the boundaries of the mixing zone as a result of the permitted discharge at Outfall 002. An exceedance of the specific conductivity limit (1,000 µmhos/cm) will indicate a change in beneficial use.

An exceedance of the ground water compliance limit for e-coli bacteria (less than 1 organism per 100 ml.) at the end of the mixing zone would trigger the installation of a ground water monitoring well at the downgradient edge of the drainfield because there is no mixing zone allowed for e-coli bacteria.

An exceedance of a ground water compliance limit(s) will require a resample be collected from the monitoring well within 72 hours of the laboratory notification of the analytical results from the scheduled sampling event. Corrective action will need to be implemented should the analytical results from the re-sample verify the exceedance(s).

Table 8. Ground Water Compliance Limits for Monitoring Well MW1A

Parameter, units	Concentration Limit
E-Coli Bacteria, organisms/100 ml	Less than 1 per 100 ml
Nitrate (as N), mg/L	7.5

Ground water corrective action could involve but not be limited to, one or more of the following measures based on the nature and extent of the potential impacts to the ground water quality.

- Identification of the probable cause and extent of the ground water quality changes.
- Installation of additional ground water monitoring wells, including an upgradient well.
- Increased sampling (frequency and/or constituents).
- Increase the efficiency of the wastewater treatment system.
- Reduce the amount of nutrients or other parameters discharged into the ground water.
- Addition of disinfection to the effluent prior to discharge, if e-coli bacteria compliance limit was exceeded.
- Supply drinking water to hydraulically downgradient residences.

XI. Nondegradation Significance Determination

The Department has determined that this discharge constitutes a new or increased source for the purpose of the Montana Nondegradation Policy (75-5-303, MCA; ARM 17.30.702(16)). The applicable water quality standards for Class I ground water are summarized in Table 1. The effluent limits for TN and TP are based on compliance with water quality standards. The proposed discharge will not exceed the water quality standard for nitrate (as N) of 7.5 mg/L at the hydraulically downgradient boundary of the standard 500-foot ground water mixing zone.

XII. INFORMATION SOURCES

In the development of the effluent limitations, monitoring requirements and special conditions for the draft permit, the following information sources were used to establish the basis of the draft permit and are hereby referenced:

ARM Title 17, Chapter 30, Sub-chapter 5 - Mixing Zones in Surface and Ground Water, September 1999.

ARM Title 17, Chapter 30, Sub-chapter 7 - Nondegradation of Water Quality, March 2000.

ARM Title 17, Chapter 30, Sub-chapter 10 - Montana Ground Water Pollution Control System (MGWPCS), March 2002.

Cherry, J.A. and Freeze, R. A., *Groundwater*, Prentice-Hall Inc., Englewood Cliffs, NJ., 1979. Chapter 2, pages 26-29.

DEQ Circular 4, 2004.

DEQ Circular 7 – Montana Numeric Water Quality Standards, February 2006.

DEQ, Memo-Regensberger, "Revised Modification of Phosphorous Concentration for Domestic Sewage in Nondegradation Reviews," October 29, 1998.

DEQ, "Nitrate Sensitivity Analysis Input Data", 1994.

DEQ, "Non-Point Source Water Quality Standard Operating Procedures" (4/1/95) at www.deq.state.mt.us/wqinfo/monitoring/SOP/Sap.asp

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map Community Panel Number 30027 0315, Effective August 1, 1984.

GWIC Database, http://mbmggwic.mtech.edu

Orenco Systems, *AdvanTex AX100 Performance Summary*, May 20, 2004

U.S. Department of Agriculture, Natural Resources Conservation Service, Soils Data, 10/25/05, 3/24/06 and http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

U.S. Environmental Protection Agency, Rev September 2000. U.S. EPA NPDES Permit Writers' Course, Helena, Montana, September, 2000, Workbook EPA 833-B-97-001.

U.S. Environmental Protection Agency, February 2002. *Design Manual: Onsite Wastewater Treatment and Disposal System*. EPA 625/R-00/008, p. 3-29 (Table 3-19) and Fact Sheet TFS-9 "Fixed Film Processes", and Table 1, TFS-51.

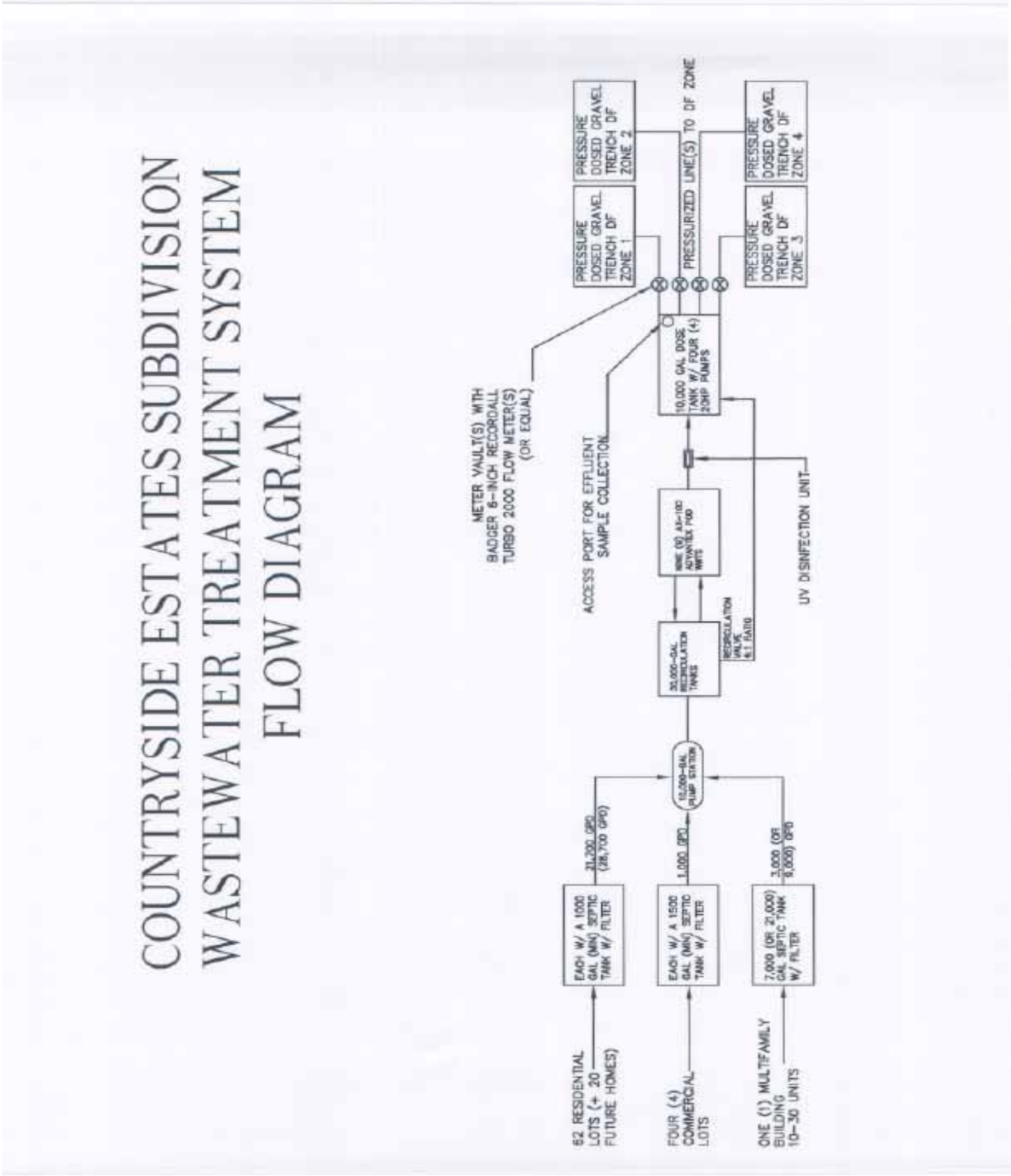
XIII. ATTACHMENTS

1 – Wastewater Flow Line-Diagram

2 - Site Map with Ground Water Flow Data, Mixing Zone, and Proposed Ground Water Monitoring Well (MW1A) Location

Prepared by: Pat Potts **Date:** September 6, 2006

ATTACHMENT 1



ATTACHMENT 2